Water-craft propulsion device

Field of the invention

The present invention relates to devices for propelling a water-craft and water-craft including such a propulsion device. Embodiments of the present invention take the form of a propulsion device for a surf-craft and a surf-craft including such a propulsion device but the invention should be considered applicable to water-craft generally.

Background of the invention

Surfing is a popular form of recreation amongst children and adults, and can be divided into body surfing in which the surfer rides the waves without the use of a board, and board surfing in which a board is used to assist the surfer to catch waves. Surf-craft used for board surfing include surfboards, bodyboards (also known as "boogeyboards"), kneeboards and waveskis.

Catching a wave when board surfing requires considerable skill and typically requires the surfer to paddle their board at a speed approaching that of the wave.

Various devices are used to assist surfers in catching waves. Surfers have been known to use glove devices with webbing between the figures in order to improve paddling efficiency, and bodyboarders are commonly known to wear flippers or fins on their feet in order to allow them to kick more efficiently to assist in catching waves.

Such devices typically increase the physical effort required to catch waves as they cause additional water to be displaced by the rider in each arm stroke or kick, and thus their extended use may increase rider fatigue.

Some riders may find that even though they are using such devices to assist them in catching waves that they are still unable to paddle their board fast enough to catch a wave. This is particularly true of children who often do not possess strong swimming skills or the ability to paddle fast enough to catch a wave.

Summary of the invention

In a first aspect the present invention provides a water-craft propulsion device for a water-craft, including:

a drive portion configured to be activated to propel the water-craft in use; and

an actuation means configured to enable activation of the drive portion in accordance with a predetermined timing sequence.

The actuation means preferably include timing means for controlling the time period for which the drive portion is activated, the timing means being arranged to override the activation of the drive means in accordance with the predetermined timing sequence.

The predetermined timing sequence can include at least one activation window in which the actuation means is operable to activate the drive portion. The predetermined timing sequence can include at least one deactivation window in which the actuation means is prevented from activating the drive portion.

The timing of the predetermined timing sequence can be measured from a time at which the drive portion is activated. Alternatively the timing of the predetermined timing sequence can be measured from a time at which the drive portion is deactivated.

The predetermined timing sequence can include an activation window of a fixed duration.

Preferably the timing of the predetermined timing sequence includes a deactivation window of a fixed duration.

In an embodiment the predetermined timing sequence includes an activation window followed by a deactivation window.

Preferably the predetermined timing sequence includes a 10 second activation window followed by a 20 second deactivation window.

During an activation window the actuation means can be configured to allow a user to selectively activate and/or deactivate the drive portion.

The actuation means preferably includes an actuation switch operable by a user to selectively activate and deactivate the drive portion and a timing module configured to restrict or allow activation of the drive portion in accordance with the timing sequence.

The actuation switch can be coupled to the timer via a wired or wireless transmission path.

The drive portion preferably includes

a propulsion means;

a motor configured to drive the propulsion means; and

a power supply.

The propulsion means preferably includes a propeller. Alternatively the propulsion means can include an impeller.

The power supply includes at least one battery. Preferably the battery is rechargeable.

The drive portion can be substantially enclosed in a housing. Preferably the housing is shaped to minimise drag. The housing includes a protective cowling substantially enclosing the propulsion means.

The housing may additionally includes one or more buoyancy chambers. Preferably the propulsion means has approximately neutral buoyancy.

The housing may additionally contain at least part of the actuation means.

In one embodiment the device can be removably attached to the water-craft by an attachment means. The attachment means preferably include one or more straps configured to be fastened around a portion of the water-craft. The attachment means can include an adhesive patch mounted between the a portion of the water-craft and a portion of the housing of the drive portion of the propulsion means.

In an alternative embodiment the propulsion device is integrated into the water-craft.

In a second aspect the present invention provides a water-craft including a propulsion device including a drive portion configured to be activated to propel the water-craft in use; and an actuation means configured to enable activation of the drive portion in accordance with a predetermined timing sequence.

The propulsion device can be integrated into the water-craft.

Alternatively the propulsion device can be attached to a non-powered water-craft. Preferably the propulsion device is removably attached to the non-powered water-craft.

In a further aspect the present invention provides a kit configured to enable a non-powered water-craft to be converted to a powered water-craft. The kit can include a drive portion configured to be activated to propel the water–craft in use; and an actuation means configured to enable activation of the drive portion in accordance with a predetermined timing sequence. The kit can also include attachment means.

The attachment means preferably include one or more straps configured to be fastened around a portion of the water-craft. The attachment means can include an adhesive patch mounted between the a portion of the water-craft and a portion of the housing of the drive portion of the propulsion means.

In a further aspect there is provided a water-craft propulsion device for mounting to a water-craft of the type including an upper rider support surface and a lower water engaging surface which meet to form a pair of longitudinally extending rails which can be gripped by a rider to hold the water-craft when in use; said propulsion device including a drive portion configured to be activated to propel the water-craft; and an actuation means including at least one actuation switch which is configured to enable activation of the drive portion, said water-craft propulsion device being configured to be mounted to the water-craft such that at least one actuation switch is mounted on, or adjacent to, a rail of the water-craft such that a rider can operate said activation switch whilst gripping the rail of the water-craft.

Optionally the water-craft propulsion device can include two actuation switches which must be activated simultaneously to cause activation of the drive portion of the water-craft propulsion device.

The water craft propulsion device can be further configured such when it is mounted to said water-craft each actuation switch is mounted on, or adjacent to, a rail of the water-craft to enable a rider to operate said activation switches whilst gripping the rail

of the water-craft. Preferably each switch is positioned in use on, or adjacent to a different rail of the water craft.

Brief description of the drawings

Embodiments of the present invention will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Figure 1 shows a schematic cut-away view of a water-craft propulsion device according to a first embodiment of the present invention;

Figure 2 shows the water-craft propulsion device of Figure 1 in relationship to a water-craft;

Figure 3 shows the water-craft propulsion device of Figures 1 and 2 and its associated mounting means attached to a water-craft;

Figure 4A shows a second embodiment of a water-craft propulsion device;

Figure 4B shows detail of a third embodiment of a water-craft propulsion device;

Figure 5 shows a schematic cut-away view of a water-craft propulsion device showing the detail of the propeller cowling and water flow surrounding the propeller; and

Figure 6 shows a surfboard having an integrated propulsion device;

Figures 7A to 7C depict a side view, plan view and end view of a water-craft propulsion device of a fourth embodiment of the present invention;

Figures 8A and 8B show side and plan cut-away views of the water-craft propulsion device of the fourth embodiment corresponding to the views of Figures 7A and 7B; and

Figures 9A and 9B depict a side view and plan view respectively of a further embodiment of a water-craft propulsion device.

Detailed description of the embodiments

Embodiments of the present invention will now be described with reference to a propulsion device for surf-craft and a surf-craft including such a propulsion device. However the invention should be considered to be broadly applicable to water-craft,

including, but not limited to surf-craft, personal water-craft such as inflatable floatation devices, boats, rafts, sailboards and the like.

Figure 1 shows a schematic cut-away view of a first embodiment of a surf-craft propulsion device which is configured to be mounted to a water-craft to provide propulsion to the craft in use. The propulsion device 100 generally comprising a hydro-dynamically shaped housing 102 in which is mounted an electric motor 104, a power supply in the form of a bank batteries 106 and a timer module 108. The motor 104 is coupled by a transmission shaft 110 to a propeller 112. The propeller is mounted external to the main body of the housing 102 but is enclosed within a cowling 114. The cowling 114 allows water flow around the propeller to enable the propeller to generate thrust when in use but sufficiently encloses the propeller to prevent a user or other person touching the moving propeller in use. The motor 104 is powered by the bank of batteries 106 and is controlled in use by the rider operating actuation means 115 which includes a push button 116 and timing module 108.

In use, the propulsion device 100 is configured to be mounted to a surf-craft. In Figure 2 the propulsion device 100 is mounted to the underside of the surf-craft 200 such that when the surf-craft is in use the propulsion means is submerged under the water. The push button 116 of the actuation means 115 is connected to the timing module 118 by an elongated wire in order to allow the surf-craft rider to operate the propulsion means from their natural position on top of the board without having to reach around to the propulsion device.

The timing module 118 forms part of the actuation means 115 its has the role of controlling activation of the motor in use. The timing module 1 18 is configured to enable the push button to be used to activate the motor during certain time periods, but not in others. In certain embodiments it may be advantageous to only allow intermittent operation of the motor so that when a surf-craft fitted with a propulsion device according to an embodiment of the present invention is being used by a child he or she is unable to drive the board at high speed away from a parent or guardian supervising their use of the device.

As will be appreciated by those skilled in the art the propulsion device 100 will typically be mounted along the centre-line of the surf-craft in order to provide balance to the surf-craft. However, offset mounting arrangements are also possible. It may also be possible to mount a plurality of drive portions of such a propulsion device to a surf-craft with a single actuation means operating them in concert. In such an arrangement the propulsion devices will typically be mounted to the surf-craft in a symmetrical arrangement about the centre-line of the board.

The drive portion of the propulsion device can be mounted to the surf-craft in a variety of ways, including with use of one or more straps fastened around the board. An exemplary embodiment of such a fastening means is shown in Figure 3. In this embodiment, the drive portion of the propulsion device 100 is mounted to the bottom of a surf-craft 200 using an attachment means 300. The attachment means 300 include a pair of straps 302 and 304 which are mounted to the housing 102 at its rear end 102a and front end 102b respectively. The straps 302 and 304 extend around the rear and the front of the board respectively and fasten to each other in an overlapping region 306 using a hook and loop fastener, such as Velcro. The drive portion of the propulsion means 100 is further secured to the underside of surfboard 200 via a double-sided adhesive label 308 which is mounted between a mounting surface 102c of the housing 102 and the underside 310 of the surf-craft 300. This double-sided adhesive label assists in preventing the propulsion means 100 from moving in an axial direction relative to the underside of the surfboard when in use.

A plurality of straps may be used to more securely fasten the drive portion of the propulsion means to the surf-craft. It is also envisaged that in some embodiments the securing straps will extend transversely around the board. This embodiment may be particularly advantageous for use on a traditional surfboard which has a pointed front end, and thus will not readily receive a strap extending around it in an axial direction. It will also be appreciated that the fastening means of the straps may constitute buckles or clips or some other fastening arrangement that will be known to those skilled in the art.

The drive portion of the propulsion device 100 can also be mounted to a surf-craft, at least in part using screw fittings. Screw fittings the type of commonly used to attach fins to surf-craft, such as bodyboards, may be particularly well suited to this use.

In further embodiments the housing 102 of the drive portion of the propulsion means 100 and the underside 310 of the surf-craft 300 may be fitted with cooperatively shaped formations to enable them to interlock with each other in order to either permanently or releasably mount the propulsion device to the surf-craft.

In the preferred embodiment, the propulsion means 100 has neutral buoyancy, that is, it will neither sink nor float when in use. Achieving this desired buoyancy can be achieved by providing sufficient air space within the housing 102 of the propulsion device 100 to provide suitable flotation to counteract the weight of the power supply and motor of the propulsion device 100. Buoyancy of the propulsion device 100 will typically be provided by way of one or more air filled chambers located within the housing (not shown).

As will be appreciated with the continued use of the device the charge levels of the power supply 106 will eventually decrease. Thus it is advantageous to provide means for either allowing access to the power supply 106 in order to change batteries of the device or remove the existing batteries for recharging or replacement. Access to the batteries 106 can be provided in a number of ways as is shown in Figures 4A and 4B. In Figure 4A a waterproof hatch 400 is provided on the underside of the housing 102 of the propulsion device 100. By opening the waterproof hatch 400 a person can access the power supply 106 for changing and/or recharging.

In Figure 4B the housing 102 is formed in two parts, namely a generally cylindrical body portion 402 and a conical nose portion 404. The nose portion 404 and the body portion 402 are attached in sealing engagement via a screw thread 406. The threaded portion may be provided with one or more o-ring seals in order to provide a waterproof fit between the two parts of the housing 102. In this embodiment, in order to gain access to the battery, a user simply unscrews the nose portion 404 from the body portion 402 then has free access to the components inside the main body 402 of the

housing 102. Other means for allowing access to the internal components can be devised..

In a further embodiment of the invention a charging jack that is accessible to a user from outside the housing may also be used to allow recharging of the batteries.

Figure 5 shows a more detailed view of the cowling portion 114 of the housing 102. The cowling 114 surrounds the propeller 112 of the propulsion device. The purpose of the cowling is to prevent the fingers of a user, or bystander from coming into contact will the propeller, 112. The cowling 114 comprises a cylindrical portion 500 surrounding the propeller 112. The cylindrical portion 500 is mounted to the main body of the housing 102 by a plurality of connection members 505. Between the connection members are a plurality of voids 504 through which water may flow into the path of the propeller 112. The flow path of water drawn into the cowling through voids 504 is shown by arrows 506. The distal end 508 of the cylindrical portion 500 of the cowling 114 may be enclosed by a mesh or cage in order to prevent contact with the propeller 112. In an alternative embodiment rather than providing a cowling of the type described the cowling may take the form of a cage which surrounds the propeller and part of the transmission shaft 110.

In alternative embodiment one or more water ducts may be provided in the housing to channel water towards the propeller. In order to either reduce drag caused by the propulsion device or provide better thrust from the propulsion device, the housing 102 may also be hydro-dynamically shaped in order to provide better water flow towards and around the propeller.

As mentioned above the propulsion device can be integrally formed with a surf-craft rather than mounted to a conventional surf-craft as described in connection with Figures 1 to 5. Figure 6 shows an exemplary embodiment of a surf-craft 600 having an integrally mounted propulsion device 602. As will be seen the propulsion device 602 is generally the same as that described in the previous embodiment having a motor 604 powered by a power supply 606 which drives a propeller 608. The operation of this drive portion of the propulsion means 602 is controlled by actuation means 610 comprising a

push button 612 and a timing module 614. Again the timing module 614 and the push button 612 are connected via a hard wired transmission path 616.

The housing surrounding the components of the propulsion means can be integrally formed with the body of the surf-craft. In such an embodiment the propulsion means can be provided with a waterproof hatch from similar to that shown in Figure 4A in order to allow access to the batteries of the power supply 606 to enable them be changed, or to enable access to the motor and/or timing module.

The use of a surf-craft including a propulsion means according to an embodiment of the present invention will now be described. In use, a rider will typically use a propulsion means in order to provide them with additional paddling thrust when trying to paddle out through the surf, or in order to give them extra speed when catching a wave. In this regard in order to turn the propulsion means on the user simply pressing the push button e.g. 116 of Figure 1. The pushbutton is connected to the timing module 108 which controls activation of the motor 104. In this regard, the timing module 108 can be configured to allow the activation of the motor in accordance with a predetermined timing sequence. The timing sequence will include at least one of activation window, in which the motor may be activated by depressing the push button 116 and at least one deactivation window in which depressing the pushbutton 116 does not cause activation of the motor.

A suitable predetermined timing sequence for allowing or disallowing activation of the motor can be chosen in a wide variety of ways. However, in the preferred embodiment the timing sequence comprises a 10 second activation window followed by a 20 second deactivation window. Thus, once the push button 116 is depressed for a first time the activation window begins and in the next 10 second period whenever the push button 116 is depressed motor 104 will be activated and the propulsion device will provide thrust to the surf-craft. After the completion of the 10 second activation window the timing module 108 enforces a 20 second deactivation window in which, in the event that the user presses the push button 116 the motor 104 is not activated.

In an alternative embodiment the timing of the activation sequence can be measured from the beginning of a deactivation window. In this regard when the user

releases push button 116 the deactivation window, and timing sequence begin. The deactivation window continues for a predetermined time set by the timing module 108 and at the end of the deactivation window the activation window begins. During this activation window the user may activate the motor 104 by depressing push button 116. If during the activation window the user chooses to release the push button a new deactivation window can be deemed to begin and the predetermined timing sequence can begin again.

Thus it can be seen that the timing sequence comprises one or more activation sequences and the activation sequences in a series. It will also be appreciated that activation sequence could comprise a plurality of activation windows separated by momentary deactivation events. This will allow a user to operate the device in a pulsed mode when repeated activation of the push button 116 is required to cause continued operation of the propulsion means.

The provision of a timing module 108 which enforces a predetermined timing sequence on the actuation means is primarily concerned with safer propulsion. It has been determined by the inventors of the present invention that in certain embodiments a safer device can be realised if a user must consciously activate the propulsion means each time they wish to use it, rather than allowing the user to simply turn the device on and leave it run indefinitely. In situations where the propulsion device is allow to run indefinitely there is a risk that the user will not be in adequate control of the device and be driven into unsafe waters by the propulsion device. It is envisaged that by allowing short pulses of the motor, dispersed by either short, or preferably extended deactivation periods that the possibility of a user propelling the board too far from shore or into unsafe waters is minimised. It is also envisaged that the short burst of, about 10 seconds will be sufficient to enable the device to be used to catch a wave when desired or help negotiate "rough spots" in the surf or punch through incoming waves.

The timing module 108 can comprise a computerised timing module, an electronic timing circuit, a mechanical timing mechanism or a combination of the three.

It is also envisaged that in certain embodiments activating the push button 116 will cause the motor to be activated for a predetermined time period dictated by the

timing module 108. A subsequent pressing of the push button may be used to reactivate the motor for the next activation window once a deactivation window of a predetermined during has passed.

As described above embodiments of the present invention can be designed which incorporate a hydrodynamically shaped body portion to improve the flow of water around the propulsion device and to the propeller. Such an embodiment is shown in Figures 7A to 7C and 8A and 8B.

In Figure 7A to 7C a water-craft propulsion device 700 is shown in relationship to a surf-craft 702. The operation the propulsion device 700 is similar to the previous embodiments. However, the embodiment of Figures 7A to 7C includes additional hydrodynamic and ergonomic features which can lead to advantages over the previous embodiments.

The propulsion device 700 includes the main body 704 which houses the mechanical and electrical components of the proportion device as described in connection with Figures 1 – 3. The propulsion device 700 also includes a propeller housing 706 in which the propeller (not shown) is enclosed. The propeller housing 706 includes a plurality of slots e.g. 708 to allow water flow into the housing 706 and around the propeller. In order to allow relatively unimpeded flow of water into the propeller housing 706 the main body of the housing 704 is shaped such that it includes a relatively narrow waist portion 704 immediately before the propeller housing 706. By narrowing the body 704 of the propulsion device 700 in this way water is able to more easily flow into the propeller housing 706.

In contrast to the previous embodiments the embodiment of Figure 7A to 7C includes actuation switch 710 mounted on its main body, rather than having a remotely located switch. The positioning of the switch 710 with respect to the body 704 of the propulsion device 700 is such that when the propulsion device 700 is fitted in correct alignment with a surf-craft e.g. 702 the switch 710 is positioned relative to the surf-craft 702 at approximately position where the rider of the surf-craft would ordinarily grip the board during use. This ergonomic feature of the present embodiment allows a rider of the surf-craft 702 to operate the propulsion device 700 whilst maintaining a secure grip on

the surf-craft 702. In use the switch 710 is positioned near enough to the edge of the surf-craft 702 such that a user can activate the switch by wrapping his or her fingers around the rails of the surf-craft 702 in a normal grip.

Figures 8A and 8B show cut-away views of the surf-craft of 7A to 7C and correspond to views of Figure 7A and 7B respectively. As can be seen from the cut-away views the main body 704 of the propulsion device 700 includes a centrally mounted waterproof battery chamber 802 in which is mounted one or more batteries 804 for providing power to the propulsion device's motor 806. The motor 806is also housed in an individual waterproof compartment 808 An electrical connection between the batteries 804 and the motor 806 are provided by an electrical coupling 810 between the two waterproof chambers 802 and 808.

The battery chamber 802 tapers downward towards its front end as can be seen in the side view of figure 8A. By tapering the battery chamber in this way, if the topmost wall of the battery chamber 802 is placed parallel to the bottom of the surf-craft to which the propulsion device 700 is attached the a minimum frontal area is presented to oncoming water. This low profile is designed to improve hydro-dynamics of the propulsion device 700.

It should also be noted that in the preferred mounting position as shown in figures 7A to 8B relative to the surf-craft the propeller does not extend beyond the back of the surf-craft. Moreover it is preferable that the housing or cowling shrouding the propeller does not extend past the back of the surf-craft.

Figures 9A and 9B depict further embodiment of a water-craft propulsion device. This embodiment differs from the previous embodiments in that rather than being powered by a traditional propeller, an impeller-based or water jet propulsion system is used to provide thrust to the surf-craft. In order to enable this form of propulsion system to be used the propulsion device 900 is shaped so as to include a water inlet 902 to allow water to reach the drive impeller or jet.

This embodiment also includes two activation switches 904 and 906. The switches are positioned on the propulsion device 900 such that when the propulsion device is mounted to a board, the switches lie in a position in which a user's hands would

ordinarily would be able to activate them whilst gripping the surf-craft. In this embodiment both activation switches which must be simultaneously depressed in order to activate the propulsion device. By requiring both switches to be depressed to activate the motor in combination with the positioning of the activation switches 904 and 906, the rider of the surf-craft is encouraged to have a secure two-handed grip on the surf-craft when the propulsion device is active.

In certain embodiments a timing module will not be used to control the activation of the propulsion device. In place (or in combination with) the timing module the propulsion device can be provided with momentary switches or a speed/throttle control to actuate and control the propulsion device. A momentary switch can be arranged such that thrust is provided by the propulsion device only whilst the switch is depressed by the user and thus effectively provides a "dead-mans" switch for the operation of the propulsion device. Speed controller circuitry can be employed which controls the level of thrust produced by the propulsion device. It will be understood that the invention disclosed and defined herein extends to all alternative combinations of two or more of the individual features mentioned or evident from the text or drawings. All of these different combinations constitute various alternative aspects of the invention.

The foregoing describes embodiments of the present invention and modifications, obvious to those skilled in the art can be made thereto, without departing from the scope of the present invention.